Drugs Used To Treat Infection: Antimicrobials


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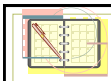
LESLIE MARTINEZ, MSNED, RN, MICN, PHN

LOS ANGELES COUNTY
COLLEGE OF NURSING AND ALLIED HEALTH

LESLMARTINEZ@DHS.LACOUNTY.GOV



What's the plan?

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- **Antiinfectives**
  - Action/Indication
  - Administration
  - Safety: Labs
  - Side Effects
  - Adverse Effects
  - Patient Teaching
- **Drug Monitoring**
- **Food Considerations**
- **Nursing Process**
- **Drug Reactions**
- **Documentation**
- **Teaching**
- **Alternative Medicine**
- **Cultural Considerations**
- **NCLEX review game**

Penicillins (PCN)

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1. Pencillins
2. Broad-spectrum
3. Penicillinase-resistant
4. Extended-spectrum
5. Beta-lactamase Inhibitors
   1. Combination abx

📖 Table 29-3

Basic Penicillins

5

- **"Beta-lactam antibiotics"**
- **Interferes with & inhibits bacterial cell wall synthesis**
- **Narrow-spectrum**
- **Bacteriostatic & bacteriocidal**
  - **Dose dependent**

Basic Penicillins

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- **Indications of use**
  - **Staphlococcal infections**
  - **Severe wound & respiratory infections**
- **Examples**
  - **Penicillin G procaine**
  - **Bicillin**

Broad-spectrum PCNs

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- "Aminopenicillins"
- Bactericidal
- Against gram + & gram –
- Indications of use: LRI, otitis media, sinusitis & UTI
- Examples: Amoxicillin & Ampicillin

Broad-spectrum PCNs

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- Amoxicillin
  - Most prescribed PCN derivative
  - Effect of Amoxicillin ↑ when taken with Aspirin & Probenecid
  - Effect of Amoxicillin ↓ when taken with Tetracycline & Erythromycin

Amoxicillin

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- Labs
  - Increased serum AST, ALT & BUN/Cr
- Food
  - Decreased effect with acidic fruits & juices
- Side effects
  - N/V/D, rash, edema
- Adverse reactions
  - Blood dyscrasias, hemolytic anemia, bone marrow depression, respiratory distress

Penicillinase-resistant PCNs

10

- Effective against penicillinase-producing Staphylococcus aureus
- Against most gram +
  - *Less effective than PCN G*

- Examples
  - Dicloxacillin (PO) & Oxacillin (IM/IV)

Extended Spectrum Penicillins

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- Effective against Pseudomonas aeruginosa
- Proteus spp., Serratia spp., Klebsiella pneumoniae
- Broad Spectrum

- Indications of use
  - Treats bone, skin, respiratory tract infections & UTI
- Examples: Piperacillin & Ticarcillin

Beta-lactamase Inhibitors

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Clavulanic acid, Sulbactam, & Tazobactam

- Indications for use
  - Penicillinase-producing Staph. aureus
- Combined with broad-spectrum abx
  - →Extending the antimicrobial effect

- Adding Clavulanic Acid intensifies the effect of Amoxicillin (Augmentin)

Beta-lactamase Inhibitors

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- **PO: amoxicillin-clavulanic acid (Augmentin)**
  - **Sinusitis, pneumonia & bronchitis**
- **IM/IV: Piperacillin-tazobactam (Zosyn)**
  - UTI, bone & joint infections, stomach infections, skin infections & pneumonia
  - **Reduce dose in renal insufficiency**

Drug Interactions

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- Amoxicillin & ampicillin ↓ the effectiveness of oral contraceptives
- K+ supplements ↑ serum K+ levels when taken with Potassium PCN G or V
- PCN & Aminoglycosides mix in IVF → the actions of both are inactivated

Safety: PCN

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- **10% allergy rate: Monitor closely!**
- **Serum BUN/Cr, LFTs & Urine output**
  - **Decrease dose with renal dysfunction**
- Side Effects
  - Rash, itching, fever, chills, N/V/D
- Adverse Reactions
  - Hypersensitivity, superinfection, laryngeal edema, wheezing, hypotension

Penicillins: Nursing Interventions

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- C&S before med administration
- Monitor for bleeding
- Observe closely for allergic reaction
  - 1st and 2nd dose (epinephrine)
  - Medical Alert bracelet
- Increase fluid intake
- Assess for superinfection
  - Stomatits & vaginitis

Cephalosporins

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- Four generations
- Beta-lactam structure
  - Semi-synthetic
- Inhibits bacterial cell-wall synthesis
  - Bactericidal
  - Cross-resistance with PCN
- Indications of use
  - Respiratory, urinary, skin, bone, joint & genital infections

Cephalosporin Generations

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First-generation
- Gram + bacteria: E. coli, Klebsiella
- Cephalexin & cefazolin

- Second-generation
  - Gram + & gram –: Neisseria gonorrhorae, Haemophilus influenzae, Neisseria meningitis
  - Cefaclor & cefoxitin

Cephalosporins

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- Third-generation
  - Gram + & gram –: Psuedomonas aeruginosa
  - Cefoperazone & ceftriaxone
- Fourth-generation
  - Gram + & gram –: Streptococci, staphylococci
  - Cefepime
  - 3 checks! Similar names.

Cephalosporins

20

- Pharmacokinetics
  - Few PO; most IM, IV
- Side effects
  - N/V/D, GI distress & HA
- Adverse reactions
  - With high doses: Increased bleeding
  - Nephrotoxicity (in CRF/ARF)

Cephalosporins

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- Drug Interactions
  - **Alcohol**: may cause flushing, dizziness, HA, N/V & muscular cramps
  - **Oral Contraceptives**: decreases effect
  - **Uricosurics:** decrease Cephalosporin excretion (i.e. Probenecid)
    - Accumulation & toxicity

Cephalosporins

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- Nursing Interventions
  - Assess for allergic reaction
  - Assess renal & liver function
  - Monitor for superinfection
  - Monitor bleeding studies, VS & UO
- Safety
  - Keep out of reach of children

Client Teaching

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- Report s/s of superinfection
  - Instruct to ingest buttermilk or yogurt for prevention with long-term use
- Complete course of medication
- Childproof caps and out of reach of children
- Infuse all meds >/= 30 min
- Report all side effects

PCN Substitutes

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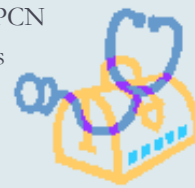
- Macrolides, Lincosamides, Glycopeptides, & Ketolides
  - Broad-spectrum
  - Abx effectiveness similar to PCN
  - Used in PCN allergic patients



Macrolides

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- Broad spectrum: Some gram -/most gram +
  - Binds to ribosomal units & inhibits protein synthesis
  - Low to moderate doses: Bacteriostatic
  - High doses: Bacteriocidal
- Indications of Use
  - STIs, GI, respiratory, & skin infections
  - Commonly used in clients with PCN allergies

Macrolides

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- erythromycin (E-Mycin)
- Extended Macrolides
  - Longer half-life
  - azithromycin (Zithromax)
  - clarithromycin (Biaxin)

Macrolides

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- Increases effect of Digoxin, Tegretol, Theophylline, Cyclosporin & Warfarin
- NOT administered IM (OUCH!)
- Azithromycin
  - Decreases effect of PCNs & Clindamycin
  - Avoid antacids within 2 hours
- Erythromycin
  - Don't take with Clindamycin or Lincomycin

Macrolides

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- Safety: LFTs & UO
- Side Effects
  - N/V/D & abdominal cramps
- Adverse Reactions
  - Jaundice/icteric, anaphylaxis, superinfection, & hearing loss
  - **Hepatotoxicity:** Erythromycin & Azithromycin + other hepatotoxics

Nursing Interventions

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- Obtain C&S
- Monitor VS & UO
- Monitor liver functioning:
  - Jaundice
  - LFT & bilirubin
- Instruct patient to report loose stools
  - Pseudomembranous colitis (C. dif)

Lincosamides

30

- Inhibit bacterial protein synthesis
- Bacteriostatic & bacteriocidal
- Clindamycin (Cleocin)
  - Most gram +
- Side effects/Adverse reactions
  - N/V, stomatitis, **colitis & anaphylactic shock**

Glycopeptides

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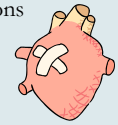
- Glycopeptide bacteriocidal antibiotic
  - Vancomycin (Vancocin)
  - Telavancin (Vibativ) Once daily
    - Select gram + bacteria & skin infections
    - Effective against MRSA



- Indications of Use
  - Cardiac surgical prophylaxis if PCN allergy

Vancomycin

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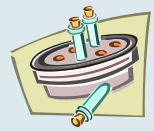
- Side Effects & Adverse Reactions
  - Thrombophlebitis, N/V, dizziness, fever
  - Ototoxicity & Nephrotoxicity
- Monitor
  - Peak & trough levels
  - Bun/Cr



Redman Syndrome (Red Neck Syndrome)

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- Red blotching of the face, neck & chest
- Toxic effect/Not an allergic reaction
- Treatment
  - Mild to moderate:
    - Benadryl & Ranitidine, and ½ IV rate or 10mg/min
  - Severe:
    - IVF PRN w/ hypotension
    - Administer Benadryl & Ranitidine
    - May restart once symptoms resolve (rate over 4 hours)

Red Man Syndrome

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Stevens-Johnson Syndrome

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- Epidermis separates from the dermis
- Hypersensitivity affecting skin & mucous membranes

Vancomycin

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- Risk of nephro & ototoxicity are potentiated with:
  - Furosemide, aminoglycosides, amphotericin B…
- Ototoxicity can be masked with Dramamine
- May inhibit methotrexate excretion = toxicity

Ketolides

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- Inhibits protein synthesis → bacterial cell death
- Telithromycin (Ketek)
  - >18 yo: Mild to mod. CA-pneumonia
- Side effects/Adverse reactions
  - HA, dizziness, N/V/D & **liver failure**

Ketolide Drug Interactions

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- Telithromycin levels ↑ with:
  - Antilipidemics, itraconazole, ketoconazole & benzodiazepines
- Telithromycin levels ↓ with:
  - Rifampin, phenytoin, carbmazepine & phenobarbitol
- Increases multiple other drug levels

Tetracyclines

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- Broad-spectrum
  - Gram - & + & other organisms
  - ↑ Bacterial resistance d/t overuse
  - Tx of H. Pylori → Peptic Ulcers w/ Metronidazole & bismuth
- Indications of use
  - Acne, rosacea, & **skin** infections
  - **Respiratory** infections & STIs

Tetraclyclines

40

- Short-Acting
  - tetracylcine (Sumycin)
- Intermediate-Acting
  - demeclocycline (Declomycin)
- Long-Acting
  - doxycycline hyclate (Vibramycin)

Tetracyclines

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- **PO**: Rapid & complete absorption in newer preparations
- **IV:** Used to treat severe infections

Tetracycline Administration

42

- Antacids, high calcium & iron drugs
  → Can prevent absorption of Tetracyclines
- Dairy products decrease Tetracycline effect
- **Doxycycline**
  - Decreases effect of oral contraceptives
  - Increases absorption of Digoxin → toxicity
  - Absorption enhanced with food

Tetracyclines

43

- Side Effects
  - N/V/D & photosensitivity
  - Teratogenic in 1st trimester (icon)
- Adverse Reactions
  - Superinfections, hepatotoxicity, CNS toxicity…
  - Labs: BUN/Cr & LFTs

Tetracycline Teeth

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Glycylcyclines

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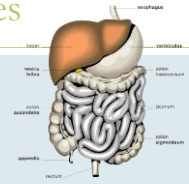
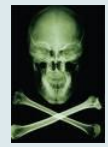


- Broad spectrum; gram + & -
- tigecycline (Tygacil)
- Indications of Use
  - Complicated skin infections, intrabdominal infections
  - E. coli, S. aureus, Klebsiella pnuemoniae

Tigecycline

46

- Side effects & adverse reactions
  - N/V/D, **photosensitivity,** HTN/hypotension, anemia, leukocytosis & thrombocytopenia
  - Hyperglycemia, hypokalemia, ↑ BUN & LFTs
- Concurrent therapy effects:
  - Oral contraceptives less effective
  - Warfarin levels may increase



Aminoglycosides

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- Inhibits bacterial protein synthesis
  - Gram -
  - Some gram + cocci are resistant → PCNs or Cephalosporins are used
- Indications of Use
  - PID, MRSA, & Pseudomonas
  - Serious infections

Aminoglycosides

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- amikacin (Amikin)
- gentamicin (Garamycin)
- neomycin (Mycifradin)
- tobramycin (Nebcin)
- No GI absorption: Primarily given IV & IM

Aminoglycosides

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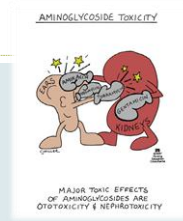
- Side Effects
  - N/V, rash & photosensitivity
- Adverse Reactions
  - **Ototoxicity, nephrotoxicity & liver damage**, thrombocytopenia & agranulocytosis



Aminoglycoside Safety

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- **Peak & Trough**
- ↑ BUN, Serum AST, ALT, LDH, Cr & bilirubin
- ↓ Serum K+ & Magnesium

1. Nephrotoxicity
   1. Renal functioning, dose & age
2. Ototoxicity risk ↑
   1. Concurrent ethacrynic acid treatment

Nursing Interventions

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- Check for hearing loss & balance
- Monitor UO
  - Report < 600 mL/24 hrs
- Peak and Trough
  - Gentamicin
- Monitor for superinfection
- Increase fluid intake

Fluoroquinolones

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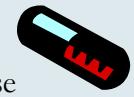
- Broad Spectrum bacteriocidal
  - Interferes with enzyme DNA gyrase
  - Gram - & gram +



- Primary indications of use
  - **UTI** & **Respiratory infections**

Fluoroquinolones

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- ciprofloxacin HCl (Cipro)
- levofloxacin (Levaquin)
- ofloxacin (Floxin)
- moxifloxacin (Avelox)

Fluoroquinolones Safety

54

- Food slows the absorption rate
- ↓ Levofloxacin drug absorption with:
  - Antacids & Iron (within 4 hrs)
- Levofloxacin ↑s effect of:
  - Oral hypoglycemics, Theophylline, & Caffeine
  - CNS reactions (tachycardia, anxiety…) can occur

Fluoroquinolones

55

- Safety: BUN/Cr & UO
  - Elevated = kidney dysfunction
  - Fluid > 2,000 ml/day
- Side Effects
  - Dizziness, photosensitivity, N/V/D
- Adverse Reactions
  - Seizures, cardiac dysrythmias & superinfection
  - Steven-Johnson syndrome

Lipopeptides

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- Bacteriocidal
- daptomycin (Cubicin)
- Indications
  - Complicated gram + skin infections, S. aureus septicemia and MRSA infective endocarditis

Lipopeptides

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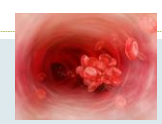

- Side effects
  - HTN, hypotension & anemia
- Adverse reactions
  - Hyper/hypokalemia, hyper/hypoglycemia, bleeding & pleural effusion
- Toxicity with tobramycin
- Increased bleeding with Warfarin

Sulfonamides

58

- Bacteriostatic
  - Inhibit bacterial synthesis of folic acid
  - Gram –
  - Prevents bacterial growth in the kidneys & bladder
- Indications of Use
  - UTI, ear infections, meningococcal meningitis, newborn eye prophlaxis & STIs

Sulfonamides

59

- Short-Acting
  - sulfadiazine (Microsulfon)
- Intermediate-Acting
  - trimethoprim-sulfamethoxazole (Bactrim, Septra)
- Topical
  - silver sulfadiazine (Silvadene)
- Can be used in clients with PCN allergy

Sulfonamides

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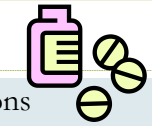

- Side Effects/Adverse Reactions
  - Skin rash/itching, photosensitivity, cross-sensitivity, & N/V/D
- Prolonged use
  - Hemolytic or aplastic anemia, thrombocytopenia, **neutropenia, & agranulocytosis**

Nursing Interventions

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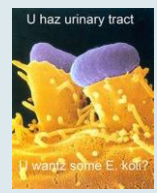
- Teaching
  - Crystalluria → Increase fluid intake
  - Sunglasses, report bruising or bleeding
- Assess renal functioning
  - BUN/Cr and UO
  - Bactrim and Septra: contraindicated in renal clients
- **Increases hypoglycemic effect with hypoglycemics**
- **Increases anticoagulant effect with Warfarin**

Urinary Tract Disorder Drugs

62

- Upper UTI
  - Pyelonephritis
- Lower UTI
  - Cystitis, urethritis or prostatitis
- UA and C&S prior to tx
- Acute Cystitis
  - Demographics
  - Signs & Symptoms



Definitions

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- Urinary Antiseptics/antiinfectives:
  - Prevents bacterial growth in the kidneys & bladder
    - Sulfonamides/Fluoroquinolones
- Urinary Analgesics:
  - Relieve urinary tract pain & burning
- Urinary Stimulants:
  - Increase urinary muscle tone

Urinary Antiseptics/Antiinfectives

64

- nitrofurantoin (Macrodantin)
  - Bacteriostatic & Bacteriocidal (dose dep.)
  - Gram - & +
- Indications of Use
  - Acute & Chronic UTI

Urinary Antiseptics/Antiinfectives & Antibiotics

65

- nitrofurantoin (Macrodantin)
- Adverse Reactions
  - Dyspnea, chest pain, fever/chills
- Nursing Considerations
  - ↓ absorption with antacids
  - Accumulates in serum with urinary dysfunction

Urinary Antiseptics/Antiinfectives & Antibiotics

66

- methenamine (Hiprex)
  - Bacteriocidal when pH < 5.5
- Indications of Use
  - Chronic UTI
- Nursing Considerations
  - Cystalluria occurs with sulfonamides
  - Encourage acidic juices & ascorbic acid (vit c)
  - Decrease alkaline food intake

Urinary Analgesics

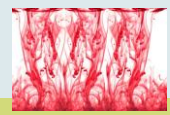
67

- pyridium (Phenazopyridine)
- Urinary Analgesic: Azo dye
  - Relieves pain, burning, frequency & urgency
- Indications of Use
  - Lower UTI
  - Concurrent antibiotic tx

Pyridium (Phenazopyridine)

68

- Clinitest: Alters the result
- Side effects/Adverse reactions
  - GI disturbances, hemolytic anemia, blood dyscrasias, nephrotoxicity & hepatotoxicity
- Teaching
  - Reddish-orange urine from dye
  - May stain contact lenses
  - Report N/V/D



Urinary Stimulants

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- Parasympathomimetics
- Urecholine
  - ↑ bladder tone
  - Produces contraction that stimulates micturition
- Which type of client would benefit from this drug class?

Urinary Antispasmotics/Antimuscarinics

70

- Relieve urinary tract spasms from infection
- dimethyl sulfoxide, oxybutynin & flavoxate
- Contraindications
  - GI obstruction
  - Glaucoma

Urinary Antispasmotics/Antimuscarinics

71

- Side Effects:
  - Dry mouth, ↑ HR, dizziness, GI distention & constipation
- Teaching
  - Report retention, severe dizziness, blurred vision, palpitations & confusion
  - Avoid prolonged heat exposure

Adverse Effects of Antibacterials

72

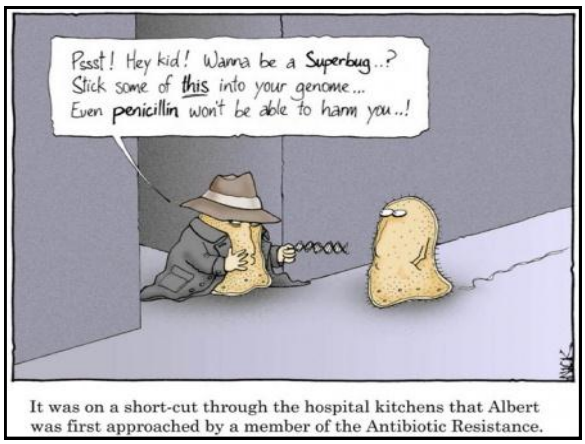
- Allergy or hypersensitivity reaction
  - Mild: Rash, pruritis & hives → antihistamine
  - Severe: Laryngeal edema, bronchospasms, cardiac arrest → epi, bronchodilator & antihistamine
  - Usually occurs in the first 20 minutes
- Superinfection
- Organ toxicity
  - Liver & Kidneys

Superinfection

73

- Secondary infection: when normal flora are killed
- Sites: Mouth, skin, resp. tract, vagina, intestines
- Fungal or Bacterial
- Broad-spectrum > 1 wk

- **Adverse reaction**
  - Notify the MD stat!

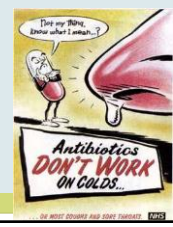


It was on a short-cut through the hospital kitchens that Albert was first approached by a member of the Antibiotic Resistance.

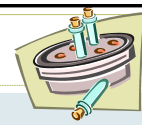
Resistance

75

- ☑ **Lessened antibiotic effect d/t misuse**
  - ☑ Used on viruses or wrong bacteria/fungus
  - ☑ Mutant bacteria survive antibiotic use
  - ☑ Taken incorrectly
- ☑ **Combating resistance**
  - ☑ New classes of drugs
    - ☑ **Abx resistant disabler**
  - ☑ Bacterial vaccines (pneumococcal)
  - ☑ Patient teaching



Peak & Trough Review



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- Peak
  - Drawn @ drug's peak of action
  - Indicates rate of drug absorption
- Trough
  - Drawn minutes before drug administration
  - Indicates rate of drug elimination
- Gentamicin Peak 5-10 Toxic Peak > 12
  Trough < 2 Toxic Trough > 2
  ~Peak is 30 minutes after IV administration

Culture & Sensitivity(C&S)

77

- Detects the infective microorganism in the blood & what drug can kill it
- **Culture**: Organism causing the infection
- **Sensitivity**: Antimicrobial the organism is sensitive to
- Draw **before** antimicrobial administration

Liver & Kidney Tests

78

- CLcr
  - **Most accurate** lab test in determining **renal function**
  - Determines dose adjusting
- BUN
  - Determines renal functioning or dehydration (high levels)
- Creatinine
  - Specific indicator of renal functioning
- LFTs
  - ALT
  - AST
  - Alk Phos

Dose Adjusting

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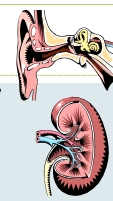


- **Organ Toxicity**
  - Liver, Kidney & Ears
  - CLcr, BUN/Cr & LFT's
  - Jaundice, UO, auditory checks
- **Critically-ill patients**
  - Immunocompromised

Nursing Process: Assessment

80

- Allergies
- Lab Results
  - LFTs, Peak & Trough, C&S
- Record/Report UO, VS
- Diet
- History
- Physical Assessment

Physical Assessment Findings

Hives

©ADAM.

- Describe wound, surgical site…
- Monitor for allergic reaction, notify MD & document findings **promptly**
  - Rash, wheezing, fever…
- Kidney/Liver damage
  - Jaundice/Icteric
  - Urine output decreased
- Superinfection

81

Nursing Diagnosis

82

1. Risk for impaired tissue integrity r/t rash.
2. Risk for infection r/t invasion of bacteria through surgical incision.
3. Noncompliance with drug regimen r/t lack of knowledge relevant to regimen behavior AEB taking two days of 11 day therapy.

Planning/Goals

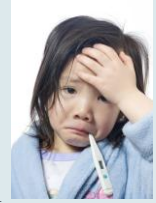
83

- Short Term
  - Client will demonstrate meticulous hand washing technique by 1300.
  - Client will demonstrate knowledge of risk factors associated with infection by 1100.

Interventions

84

- Send labs, swabs…
  - **Before** antibiotic administration
- Assess for Allergic Reaction
  - Medical Alert bracelet
- Monitor temperature
  - 1 hr after antipyretic
  - Administer 2nd antipyretic prn



Patient Teaching

85

- Teaching Plan
  - Indication of use
  - Schedule/duration
  - Food considerations
  - Interaction with herbs & other medications
- Validation of Understanding
- STI Prevention
- Hand Washing
- Take full course of antibiotic as directed
  - Finish full Rx
  - Prevent resistance
- Report side effects/ adverse reactions
  - Superinfection

Evaluation

86

- Infection ceased
- Adverse reactions
  - Superinfection
- WBC count WNL
- Afebrile
- VSS: i.e. HR, RR

Cultural Considerations

87

- Alternative Practices
  - Curandero/healer
- Language Barrier
  - Translator
- Drug Schedule
  - Alternative methodology

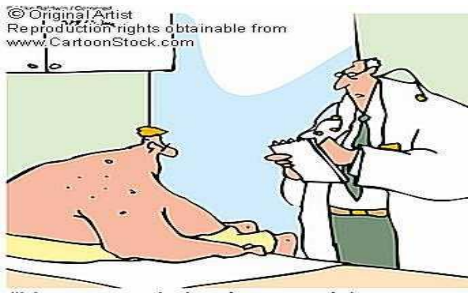
Complimentary, Alternative & Traditional Medications

68

- Client Preference
  - Homeopathic vs. Rx
    - Interactions with Rx
  - Previous experience

- Teaching
  - Stress importance of medical regime
- Family Involvement
  - Teach client with family at bedside

Questions?



"It's a prescription for one of those new super-antibiotics. You won't just get better, you'll get even."